

GIS And Planning Support System For Klang Valley Region, Malaysia

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Abstract

Metropolisation process brings numerous benefits to the quality of urban life and environment but at the same time leads to problems such as uncontrolled development, urban sprawl, congestion and the increasing cost of public services to cater for new infrastructure. Apart from that socio-economic disparity between regions becomes more significant, compounded by increasing rate urban poverty and the risk of social exclusion. Thus, the activities of controlling and monitoring urban development are crucial. The understanding of the urban system that promotes urban growth is also imperative for the purpose of policy making, formulating development strategies as well as development plans preparation. Apparently, the dynamic nature of planning and monitoring of development such as in Klang Valley, the fastest growing region in Malaysia, necessitates a 'tool' for continuous monitoring, evaluation and analysis of current environment as well as assessing the capacity for future development. As such, the development of a comprehensive database and GIS-based planning application under the project named "Application of Geographical Information System for Klang Valley Region (AGISwlk)" was initiated in 1995. The implementation of AGISwlk had been directed toward organisation of the system to facilitate immediate query and analysis, monitoring of development planning as well as spatial modelling. The project had since undergone intensive enhancement in its database structure, data quantity and quality, analysis approach and techniques as well as system customisation and integration to include the ability to provide alternatives in development scenarios. The application was further enhanced to include the development of AGISwlk web-based GIS application and establishment of the Integrated Land use Assessment (ILA) model. This paper will discuss the development, organisation and application of GIS for urban metropolitan management of Klang Valley Region, Malaysia.

INTRODUCTION

In the process of planning and decision making, the recent advancement in the field of information technology has provide vast opportunities for testing new approaches to

computer processing of geographically referenced data, thus adding new dimensions to data management, data analysis, generation of development scenarios and data presentation. The advent of Geographical Information System (GIS) has created immense opportunity for the development of new approaches to the computer processing of geographically referenced data. With this technology, a more effective solution to various spatial-related problems including those associated with planning matters can be achieved. GIS which come as a complete package with the capability in capturing, storing, updating, manipulating, analysing and displaying of all forms of geographically referenced information, has proven to be an appropriate tool for regional planning and monitoring.

In response to the current need for the application of information technology, Ministry of Federal Territories has developed a comprehensive database and GIS-based planning application under the project named "Application of Geographical Information System for Klang Valley Region (AGISwlk)" to be used as a planning support tool in formulating and evaluating development policies and strategies as well as coordinating and monitoring in the development of Klang Valley. This project was considered successful and had significantly contributed to the understanding of the development attributes in the Klang Valley region. It has also assist in the planning, coordinating and to monitor development programme of the area through utilising every potential in the system mainly as a decision support tool. To certain extent, AGISwlk is seen able to improve the decision-making process pertaining to the planning and monitoring of the region.

However, the project had since been undergoing intensive enhancement in its database structure, data quantity and quality, analysis approach and techniques as well as system customization and integration to accommodate with the fast changing IT environment and requirement of the Ministry of Federal Territories (KWP). The AGISwlk database was designed and developed to support nine application modules, proposal of an Integrated Land use Assessment (ILA) model, and continuously applied to a case study. Above all the applications, a user interface and web GIS was also developed to facilitate an easy and friendly use of the system. The entire design and development of the AGISwlk project will be described in this paper.

INFORMATION SYSTEM AND SPATIAL PLANNING

The planning authority must increase their effectiveness by developing innovative ideas in carrying out their functions. The urban system can no longer be treated in terms of simple land use and traffic concepts. The planner's conception of the urban system must be extended to include a host of social, political and economic variables. The mixture of problems which must all be resolved together creates a situation in which many alternatives must be tried, combined, improved and tested intellectually and practically, and further disseminate to the public.

The Role of GIS and Planning Support System in Urban Planning and Monitoring

Much of regional planning activities have to do with the use of land and how the different types of land use relate to one another. As such, spatially referenced data which includes parcel boundaries, buildings, ownership of land and so forth are a fundamental part of an information-based approach to regional planning. This information combined with socio-economic data such as the population census and environmental data, provides more meaningful information for the planners and decision makers. Planning methodology has changed over the years following the shift of emphasis from producing plan, which described a state of affairs expected of some future date, to one acknowledging the

continuous and cyclical nature of planning. This necessitates planning to be based on the identification of needs and goals, the formulation and evaluation of alternative courses of action and monitoring of adopted programmes. It can be traced that the development of planning support system run parallel from the 'database' to 'information' approach, starting from a focus on applied science in the 1960s through a profound consideration on the political process in the 1970s and to an emphasis on communication in the 1980s (Brail & Klosterman, 2001). The evolution of sciences and technology has effected the change of planning decision method. Planning support system (PSS) and decision support system (DSS) is one of the tools to optimise development strategically in planning.

The Geographic Information Systems (GIS) is seen as the most appropriate solution to addressed spatially referenced data. GIS provide the facilities to deal with the data requirement for the functions mentioned above. One important GIS capability is in handling both digital cartographic data and the associated databases of attribute information for map features (Healey, 1988). GIS systems can store the map coordinates of point locations, linear and area features. These features have attributes that must be stored in the database. Once all the data are stored, both the digital map and the database can be manipulated simultaneously. This is particularly important in many land use planning applications, which require data on a wide variety of physical and environmental attributes. Since the geographic information is stored in its primary form, analysis can be more quantitative and rational. The modelling stage which is called for in planning process requires planner to make explicit their criteria for the selection of alternative programmes. This encourages the selection of objective criteria, based on real data about the area under study.

GIS has proved to be invaluable tool for evaluating alternative solutions to urban planning problems especially in environmental issues. The database developed can be extensively interrogated to generate several alternative solutions to urban strategic planning problems. Numerous scenarios, which take into account the socio-economic characteristic of urban dwellers, development constraints, availability and suitability of land for a particular type of development can be generated. The GIS capabilities as a management tool is further enhanced through integration with PSS and DSS.

Requirements for Planning Support System

The evolution of sciences and technology has effected the change of planning decision method. Planning support system (PSS) and spatial decision support system (SDSS) is one of the tools to achieve quality planning and optimize development. PSS are (or at least can be) useful tools for the planner, public officials, and the community (Brail and Klosterman, 2001). PSS is a combination's of GIS data, urban model and presentation technique using computer for planning support base on community. PSS is also a tool for planner, public officer or community in development plan using computer base software (Brail and Klosterman, 2001). PSS structure and information access should visualize the world reality and support the capabilities for analyzing, prediction and planning decision. Generally, PSS involved urban database and usage of simulation database model in urban planning that can interact with planner through dialog module (Figure 1). According to Klosterman (2001a), the perfect PSS would be a fully integrated, flexible, and "user-friendly" system that allows user to run the appropriate models to determine the implication of alternative policy choices and different assumptions about the present and the future.

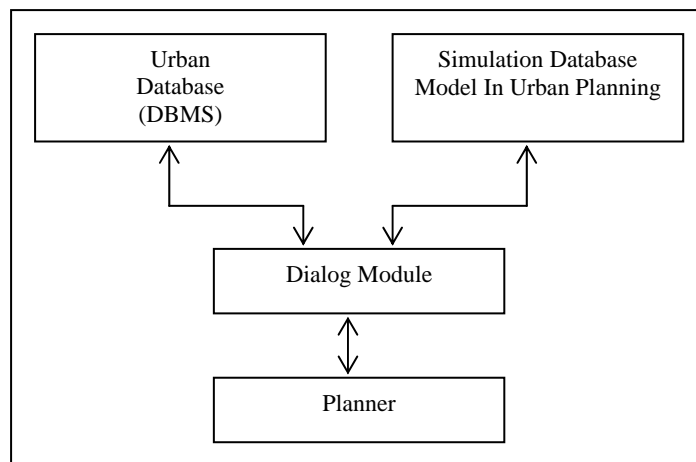


Figure 1: General Concept of Planning Support System
(Yaakup *et al.*, 2000)

FACILITATING KLANG VALLEY URBAN METROPOLITAN PLANNING AND MONITORING WITH GIS AND PLANNING SUPPORT SYSTEM

Klang Valley Region has of late shown all the evidence of going through the metropolisation process (Yaakup *et al.*, 2004). The region is experiencing the highest rate of urban growth in the country. Faced with rapid growth, there is constant pressure on most urban areas in Klang Valley region to improve services while reducing costs, and to be more efficient and effective in its daily operations and management activities. The issues accompanying metropolisation process have long been of prime concern. It is aware that the process which indeed brings numerous benefits to the quality of urban life and environment, would also project negative effects in various aspects including economy, ecology and sociology. Rapid development and expansion of city limits have either directly or indirectly affected environmental quality, causing increase in temperature, geohazard occurrences as well as pollution from noise, air and water. Other problems include uncontrolled urban sprawl, congestion and increasing cost of service to cater for new infrastructure apart from the awaiting challenges such as socioeconomic disparities between regions, urban poverty and increase risk of social exclusion (Yaakup *et al.*, 2005a).

Apparently, the challenge of metropolitan solutions to urban change involve among others, the requirement for institutional frameworks which can manage the impacts (“externalities”) accompanying the emergence of new patterns of interaction involved in the process of change, both through anticipating them and building them into policies, regulations, plans, and investment projects and also in mitigating their negative impacts (Cohen, 1999). As such, metropolitan frameworks need to be viewed in terms of a set of longer term of criteria for urban management.

However, GIS alone cannot serve all the needs of planning because the current generation of “general purpose” systems cannot easily accommodate the particular informational, computational, and display needs of planning (Harris and Batty, 1993).

Relative to the rapid land use growth, various issues and problems arise especially those pertaining to environmental pollution, land use conflicts, as well as the availability of land for future development. The changes that occur necessitate continuous monitoring to ensure sustainable development in the environmental as well as socio-economic aspects. More important, assessment of these changes is crucial not only to understand and review current development scenarios, but also to predict changes that will occur, formulate policies and strategies, as well as control development. Toward better management of the metropolitan growth, faster planning decisions and careful management are imperative. Currently, more efforts are directed at assessing the ability to supply land and supporting infrastructure to meet future needs. What needed is a tool to better manage outward growth and channelling development into designated growth areas so as to strike a sustainable balance for economic growth and protection of environmental assets (Yaakup *et al.*, 2005a). Some of the important functions include the ability to retrieve information rapidly and efficiently, model different scenarios and evaluate alternative solutions generated by various modelling procedures. The GIS capabilities as a regional planning and management tool is further enhanced through integration with PSS and DSS.

Application of Geographical Information System for Klang Valley Region (AGISwlk)

In response to the current need for application of information technology for development planning and monitoring purpose, the Ministry of Federal Territories as the coordinator in the planning and development of Klang Valley had initiated the development of a comprehensive database and GIS-based planning applications under the project named "Application of Geographical Information System for Klang Valley Region (AGISwlk)" in 1995.

This project was considered successful and had significantly contributed to the understanding of the development characteristic of the Klang Valley region and helped in planning, coordinating and monitoring development programmes of the area through utilising every potential of the system mainly as a decision support tool. To certain extent, AGISwlk is seen able to help improve the decision-making process pertaining to the planning and monitoring of the region. However, the project had since been undergoing intensive enhancement in its database structure, data quantity and quality, analysis approach and techniques as well as system customization and integration to level with the fast changing IT environment and requirement of the Ministry of Federal Territories. Generally, the AGISwlk enhancement based on several objective, that is:

- i. Enhance AGISwlk capabilities refer to Klang Valley development issues.
- ii. Establish application and analysis based on new database
- iii. Extensive the usage of AGISwlk through intelligent sharing and web GIS.
- iv. Continue transfer technology effort between KWP and consultant.
- v. Use Planning Support System (PSS) to generate and evaluate WLK development scenario

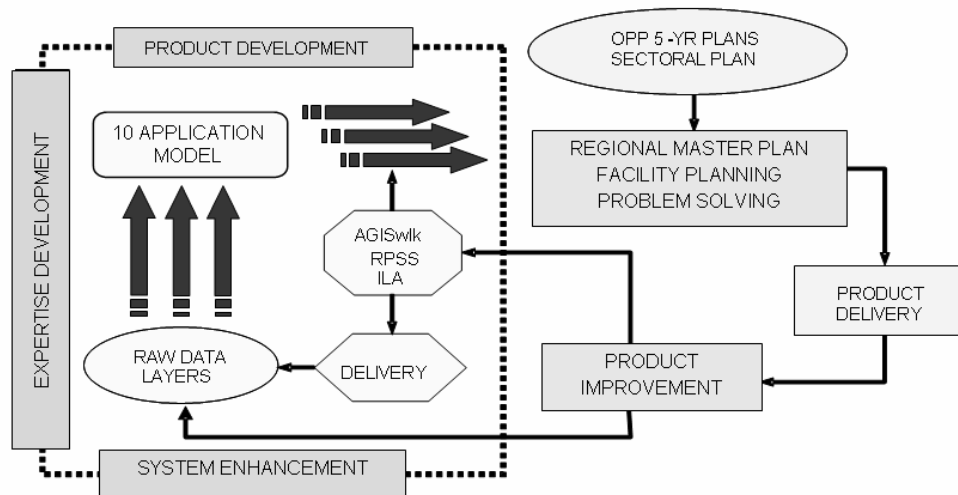
The implementation of AGISwlk faces several development stages and enhancement. Table 1 shows the development of AGISwlk implementation phase. AGISwlk enhancement derived from the framework of product development, Ministry of Federal Territories (Figure 2), thus based on products such as:

- i. Klang Valley Region Perspective Plan (PELAWI)
- ii. Problem Solving
- iii. Facility Planning

Table 1: Chronological Development of AGISwlk

<i>PHASE</i>	<i>SCOPE OF IMPLEMENTATION</i>
Phase I <i>SISMAK`95</i>	<ul style="list-style-type: none"> ▪ Pilot project in studying the possibility of GIS implementation in Klang Valley (KV). ▪ Developed GIS database covering an area of 4.5 km x 2 km (PWTC and National Mosque area) ▪ Completed in three months and successfully create awareness in the role of GIS in planning
Phase II <i>GISwpkl`96</i>	<ul style="list-style-type: none"> ▪ Database development for Kuala Lumpur Town Centre and government land in Wilayah Persekutuan Kuala Lumpur (WPKL). ▪ Completed in one year and successfully showed the comprehensive usage of GIS to plan and manage WPKL development.
Phase III <i>AGISwpkl`97</i>	<ul style="list-style-type: none"> ▪ GIS application and database updating for WPKL area and developed six application namely Identification of Risk area; Built-up area; Squatters; Pollution; Public amenities; and Population.
Phase IV <i>AGISwlk`98</i>	<ul style="list-style-type: none"> ▪ Extensive database development for the whole area of Klang Valley region which include WPKL, Gombak, Hulu Langat, Petaling and Klang district. ▪ Two application added to the previous application develop in AGISwpkl`97 : Transportation and Utilities application ▪ Developed AGISwlk customization system for easier data access
Phase V <i>AGISwlk`99 enhancement</i>	<ul style="list-style-type: none"> ▪ Maintenance and enhancement phase for AGISwlk system and previous application. ▪ Two new applications further added to the previous application : Tourism and Geo-hazard application ▪ Design and developed prototype of AGISwlk web.
Phase VI <i>AGISwlk 2001-2005 enhancement</i>	<ul style="list-style-type: none"> ▪ Database structure enhancement and data model migration. ▪ Developed Integrated Land use Assessment (ILA) model and customize system to include ILA Planning Support System. ▪ Establish application modules and web AGISwlk interface function to promote public access application and data sharing among stakeholders.

Source: AGISwlk Final Report, November 2004



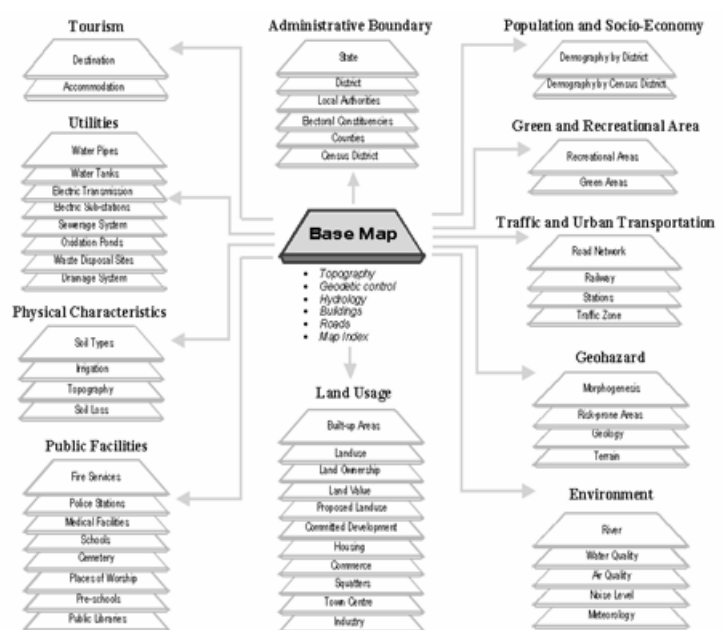
Source: Laporan Awal AGISwIk 2001-2005, Januari 2002

Figure 2 : Framework of Product Development, KWP

AGISwIk's Database & Data Accessibility

The AGISwIk's database formally developed adopted the coverage data model approach. The database consisted of various elements and data layers (Figure 3) prepared to support the sectoral application modules including base map, administrative boundary, physical characteristics, land development, population and socio-economic, environmental quality, traffic and urban transportation, green and recreational areas, public facilities and utilities (Yaakup *et al.*, 1999).

The recent enhancement of AGISwIk database took into consideration the need for multi-user and simultaneous access especially for the purpose of data updating. These require effective database management system and GIS tools to manage large pools of geographic data such as AGISwIk's. Hence, the database enhancement had adopted the geodatabase data model approach (Figure 4). Microsoft SQL Server is used as the DBMS while ArcSDE provides open interface to the relational database for data storing,



Paper Presented at the Asia GIS 6th Internat
10th March 2006, Universiti Teknologi Malaysia, Malaysia.

Figure 3: AGISwIk's Database Elements and Map Layers

updating and management apart from serves as the application server for exchanging data with various application including ArcGIS Desktop and the internet.

AGISwtk provided three medium for access to its database i.e. via ArcGIS Desktop, AGISwtk User Interface and Web. The web function provide user to access and make operational function at the ArcIMS data layers through internet to integrate data centre from AGISwtk database. The hardware and software for implementation of AGISwtk had been upgraded from time to time based on the need of user and GIS application function. Procurement of software includes ArcGIS ArcView for concurrent users, Arc SDE, ArcIMS and Microsoft SQL Server. Altogether, 3 types of server were used i.e. AGISwtk Web server (ArcIMS), ArcGIS application server and AGISwtk database server (*Geodatabase*) located in SAN. Accessibility to the database had also been enhanced through installation of high speed network system in the KWP building. For security purpose, *firewall* (based on hardware and software) is placed at the web server and database (based on software) to protect from hackers.

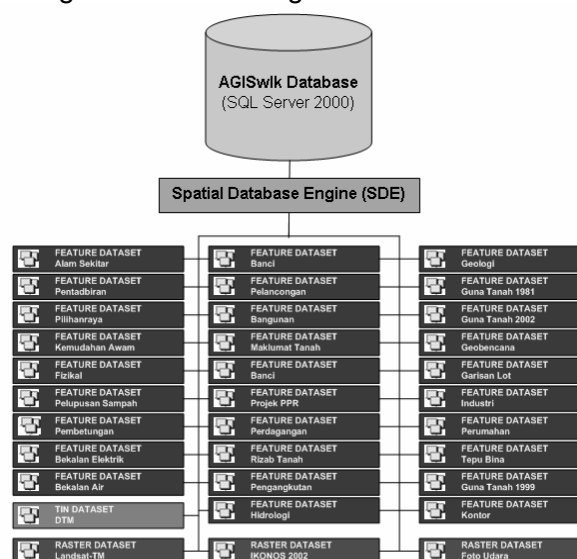


Figure 4 : AGISwtk Geodatabase Model

Planning Applications

KWP has embarked on developing a regional planning support system (RPSS) focussing on scenario building, measuring development impact and a tracking module to monitor and measure regional plan targets (including structure plans). To support the system, AGISwtk have concentrated on 3 main applications: ILA; sectoral application and specific case study (Figure 5). The application modules of AGISwtk were initially developed base on relevant sectors associated with development planning and monitoring of the region. Various analyses were carried out under each module through adoption of the spatial modelling techniques using various GIS spatial analysis functions. Gradually, AGISwtk application is enhanced through improvement of analysis methods, model and criteria based on sectoral planning needs. The database previously developed based on macro data approach was subsequently upgraded to provide comprehensive lot-based data especially for supporting analyses needed for deriving solutions to specific problems at micro level.

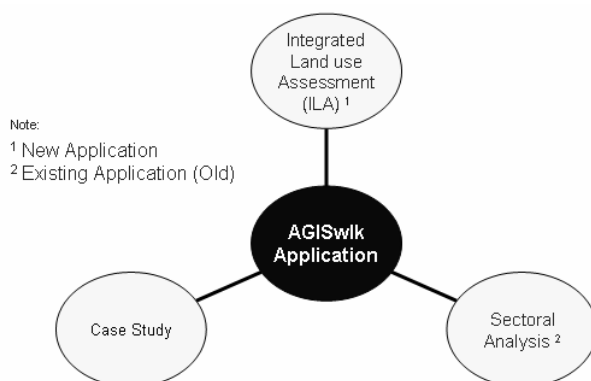


Figure 5 : Development and enhancement of AGISwtk Application

i. Integrated Land use Assessment Model

The introduction of ILA as an integrated land use planning approach that applies the GIS analysis capabilities while supported by the use of planning support system (*What if?*) is seen as a good alternative for achieving better and more rational decisions. The developed model is expected to dynamically support the preparation of the Klang Valley Regional Master Plan (PELAWI). ILA is also

expected to accommodate the main tasks of the Ministry of Federal Territory (KWP) concerning the development of Klang Valley which are regional planning, facility management as well as problem solving. It took five years to establish the development of ILA model and verify the concept, and ILA is still under research and development (R&D) process. For the time being, ILA study undertaken is focusing more on model development and identifying the deriving factors involved; and conducting several case studies to establish the methodology using different software and methods (Yaakup, 2005b). ILA emphasizes on the concept of integration whereby relationship exists between the database developed in AGISwtk and implementation of application-based analyses in AGISwtk, with the use of planning support systems (Figure 6). The ILA Model is dynamic in approach, providing flexibility for users in manipulating the selection criteria and organising them on priority basis depending on the development strategies considered. The assessment technique in ILA adopts the GIS spatial analysis technique combined with the weighting and sequential techniques. ILA involves two types of assessment namely Land Resources Assessment and Land Capacity Assessment. Two case studies were conducted in applying the ILA model. The first case study aimed to identify and verify all the relevant factors necessary to generate of development scenarios alternatives using 'what if' approach. While the second case study was conducted to evaluate the alternative scenarios and select the best scenarios using a decision support software (DSS).

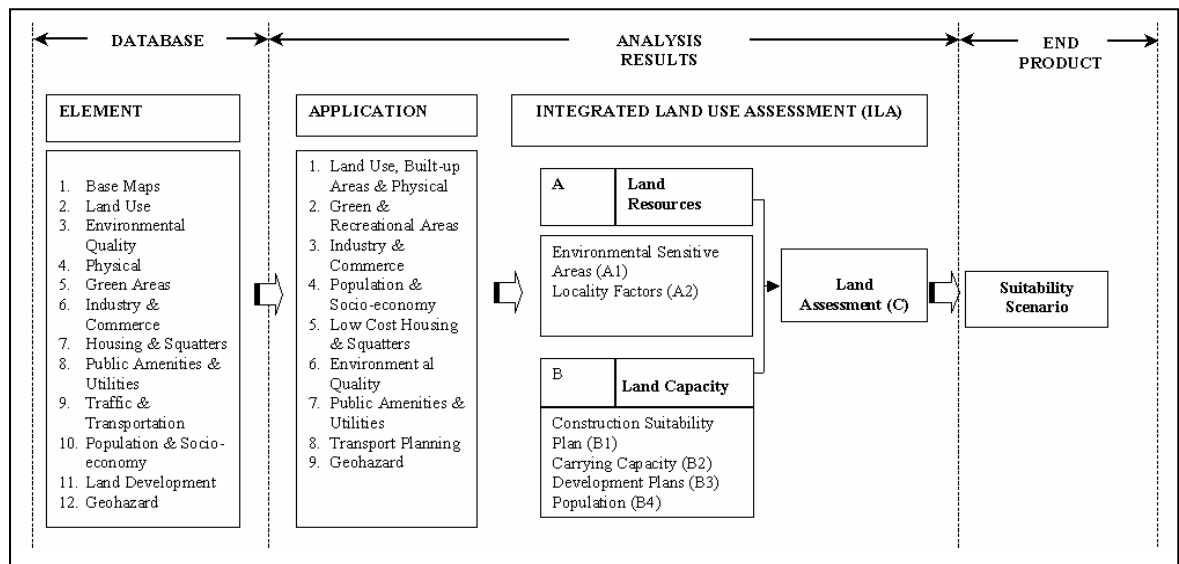


Figure 6 : The Concept of Integrated Land Use Assessment (ILA)

ii. Sectoral Application

AGISwtk had initially been designed and developed nine sectoral namely land use, built-up area and physical; green and recreational areas; industry and commerce; population and socio-economy; low cost housing and squatters; environmental quality; public amenities and utilities; transport planning; and geo-hazard. In order to support these applications, various elements of data have been prepared and compiled in a database (Yaakup *et al.*, 1999). It was to be used as a planning support tool for coordinating and monitoring the development of the region. Various analyses were carried out under each module through adoption of the spatial modelling techniques using various GIS spatial analysis functions and ArcGIS model builder. This are some example analyses carry out from land use, built-up area and physical application.

Land Use and Built-Up Area Application

The application was developed to study land availability, identify suitable area for development and land agriculture. Based on several criteria, analysis technique and spatial modelling, analysis was carried out. The analysis on land availability indicates that about 27.4% of the total area of the region is still available for development. This was based on the built up, recreation, road, river and forest area criteria.

The suitability development analysis was intensively interrogated to derive the areas having potential for development as well as those under threat for development. Figure 7 presents 41.2% potential to develop where the development has largely taken place in the western zone of the region in line with the potential of the area and the newly completed highway in the region. Although the development is limited in the eastern zone due to hilly landform, of late, this area has also been encroached upon. A strong policy on hill land development needs to be formulated to protect the area against any development which is environmentally detrimental.

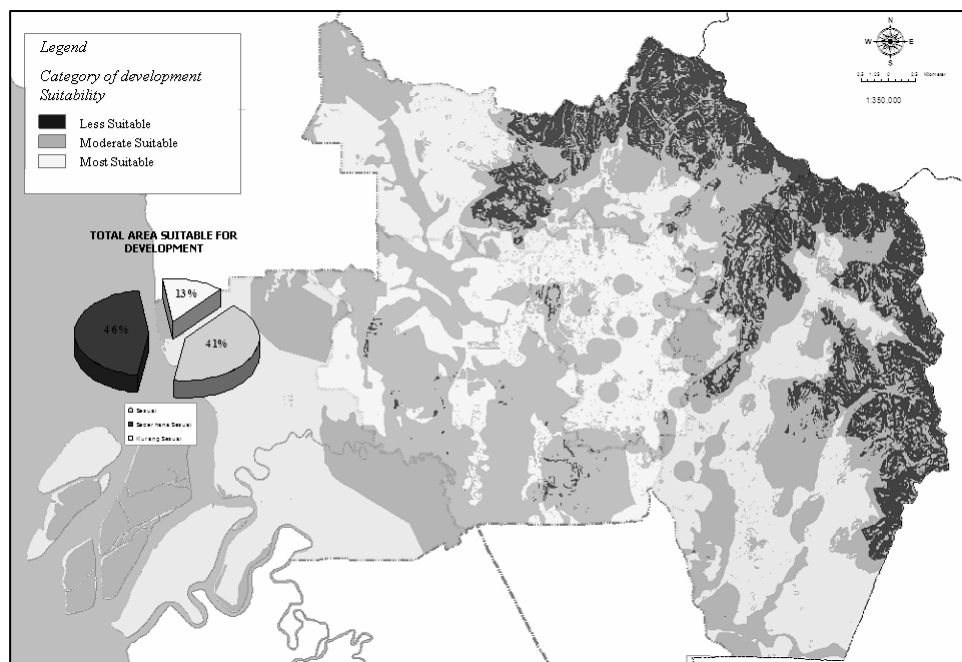


Figure 7 : Suitable Area For Development

iii. Case Study

The case study implemented based on problem solving approach. These case studies carry out as one of training to use GIS in studying current planning issues at Klang Valley. Special case study conducts to train and educate KWP officer in applying GIS technology into their daily work activities. There are three case study implemented that is study project of Dataran Perdana; Stormwater Management and Road Tunnel (SMART) Project and Kampung Baru development studies. The first case study is aimed to identify suitable development proposed to Dataran Perdana considering land resources and land capacity factors based on current situation analysis. While the

second case study was conducted with the attempt to evaluate SMART project upon surrounding area through the development scenario. The third case study carried out is to study the suitability of development proposal at Kampung Baru.

AGISwlk Web Application

The AGISwlk Web Application for Klang Valley was initiated as an extension to the prior developed database and application modules of AGISwlk. The web-based GIS applications developed adopted the three-tier client/server architecture comprising three main parts namely Clients, Middleware/Application Server and Data Storage (Yaakup *et al.*, 2001). Two modules build up to serve two different target groups. The first module, which is the Public Interactive Maps Application aimed at providing information on Klang Valley apart from inviting participation from the general public. While the second module known as the Stakeholders Application was designed for the purpose of data sharing and collaborative planning between government agencies and planning authorities directly involved in the planning and management process (Yaakup *et al.*, 2005a). The AGISwlk web application was prepared using the ArcIMS software and provides two types of web viewer namely the HTML Viewer for Public Interactive Maps Application and Java Viewer for Stakeholders Application.

i. Public Interactive Maps Application

The GIS web page was developed with the aim to facilitate users, especially clients to acquire information in digital form. The web page acts as a source of reference in making decision and evaluation for planning and development purposes where Klang Valley is concerned. This hopefully will contribute to better-informed society in the metropolitan region (Yaakup *et al.*, 2005c). Through access to the interactive maps interface, users are allowed to retrieve information base on the eight application modules provided namely public facilities, industries and commerce, tourism, physical characteristics and built up areas, green and recreational areas, land use, housing as well as population and socio-economy. The application provides user-friendly and interactive means for map display and GIS operations including *Zoom In*, *Zoom Out*, *Pan*, *Hyper Link*, *Full Extension* and *Identify* for users to access and retrieve the required information. In addition, several analyses results are also made accessible, for example, those associated with the *Integrated Land Use Assessment* (ILA) study to encourage users to participate in evaluating the model as well as final results for further improvement.

ii. Stakeholders Application Module

To coordinate development in Klang Valley, the use of GIS for planning and monitoring extends beyond the development of a comprehensive database. The AGISwlk data needs to be integrated with the local authorities' and agencies' directly involved in planning and monitoring of the region. A web-based GIS application for stakeholders was developed to integrate the data set and to encourage data sharing between various agencies involved in shaping the urban environment in Klang Valley region.

This application caters for two types of data to be shared, which are the AGISwlk's data and Stakeholder's data. Certain AGISwlk data, which is believed to be of common needs, will be

made accessible to all relevant agencies. Users will be able to access the data either in the vector format or image, such as IKONOS, directly from the AGISwtk's database apart from carrying out simple GIS operations such as *overlay and buffer* through integrating data from diverse sources. While data known to be confidential and require certain extent of control will be made available upon request.

The means provided for sharing of AGISwtk's data allow users to use the data as reference in upgrading and updating, apart from as supplement to, their existing spatial data. This helps overcome the problem of costly other than time-consuming database development. Stakeholders will still perform their own task of capturing, storing and maintaining data relevant to their organisational operations. AGISwtk's web-based stakeholders application which act as the 'hub homepage' will provide access to aggregated subset of transactional data, present a visual user interface and allow for cross-disciplinary analysis. This is achieved through agreement with data providers. The need for a two-way communication between AGISwtk and the stakeholders led to the idea of distributed data access that not only support data exchange and sharing but also discussions, especially for the purpose of certain decision making. This method will enable stakeholders to complement each others' need and hence ensure the validity and reliability of data (Yaakup *et al*, 2005c).

Basically, stakeholders need to have their own URL address to enable communication. The stakeholders' servers will store their own data in the form of image or spatial data which are compiled in the form of AXL, mxd or JPG files. All the data to be shared will be kept in the map service generated in the web servers. Users will be allowed to access GIS data by choosing the map service provided by each map server. Username and password may be required for access of certain map service. Catalogue windows will be provided to allow users to select the data to be retrieved to carry out analysis relevant to their decision-making requirement.

At the moment, work is still underway in establishing collaboration with all possible government stakeholders. It is envisaged that through continuous development, application and evaluation at the regional spatial scale, the on-line GIS systems can be possibly extended to all local authorities and stakeholder agencies so as to move toward better governance (Yaakup *et al*, 2005c).

Skill Development and Transfer of Technology

The single asset in implementing the GIS development is human resources. Human resources is one of the factor contribute in GIS implementation success. Therefore, transfer technologies have been one of the keys to educate KWP staff in their GIS understanding and capabilities. Since AGISwtk development, KWP staff has received several GIS training classes such as create and manage GIS database, conducting GIS analysis, manage and maintain web GIS. Apart from that, planning programs also designed to enhance KWP staff knowledge, such as on

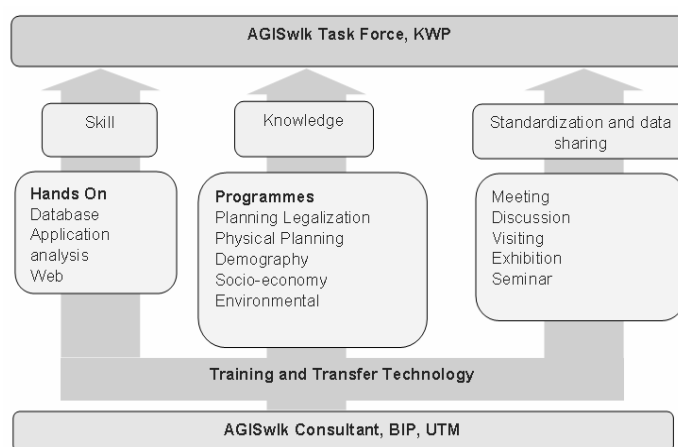


Figure 8 : Conceptual implementation of AGISwtk technology transfer

planning law, physical planning and study on demography (Figure 8).

CONCLUSION

The widespread introduction of innovative technologies such as the use of GIS has provided an exciting potential for geographic information to be used more systematically and by a greater diversity of discipline than even before. GIS has proved to be invaluable tool for evaluating alternative solutions to urban planning problems. Planning database can be extensively interrogated to generate several alternative solutions to urban strategic planning problems. GIS provides a powerful tool for managing information. Whether the information is land use, transportation, census data, property management, suitable locations, or any number of other factors, GIS can store, analyze, retrieve, and display that data.

However, it should be noted that the implementation of these technologies involves far more than hardware and software decisions. Effective implementation rests on a thorough and systematic evaluation encompassing planning, operational, organizational, institutional, personnel, financial and technical aspects. More research and attention need to be directed toward organizational and institutional issues, as well as developing the technology for planning and management purposes.

The GIS for Klang Valley is considered as a comprehensive database at the regional level. The database was designed to cater for nine application modules as identified by the regional authority. A considerable time and effort was spent in the data gathering and bringing it up to a common platform and standard data format. The project is considered successful and significantly contributes to the understanding of the development characteristics of the Klang Valley region and thus helps in planning, coordinating and monitoring the development programs of the area. The challenge that remains is in updating and maintaining the database and utilising every potential of the system mainly as a decision support tool in planning and monitoring of urban development of the region.

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